

# INSTRUCTION BOOK FOR



**MODELS 8730/31/38**  
**ECONOLOAD<sup>®</sup> LOAD RESISTOR**

MP MASTER



MA34312

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## MODELS COVERED IN THIS INSTRUCTION BOOK

8730  
8731  
8738

INSTRUCTION BOOK

FOR

MODELS 8730/31/38

ECONOLOAD® RF LOAD RESISTOR

**BIRD**

**Electronic Corporation**

30303 Aurora Road, Cleveland, Ohio 44139-2794  
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## SAFETY PRECAUTIONS

The following are general safety precautions that are not necessarily related to any specific part or procedure and do not necessarily appear elsewhere in this publication.

Keep away from live circuits.

Operating personnel must at all times observe normal safety regulations. Do not attempt to replace parts or disconnect an RF transmission or any other high voltage line while power is applied. When working with high voltage always have someone present who is capable of rendering aid if necessary. Personnel working with or near high voltage should be familiar with modern methods of resuscitation.

Warning: Warning notes call attention to a procedure, which if not correctly performed could result in personal injury.

Caution: Caution notes call attention to a procedure, which if not correctly performed could result in damage to the instrument.

The following will appear in the text of this publication and are shown her for emphasis.

```
*****
*                               W A R N I N G                               *
*                               *                                           *
* When using dry cleaning solvents, provide adequate                     *
* ventilation and observe normal safety precautions.                     *
* Many dry cleaning agents emit toxic fumes that may be                 *
* harmful to your health, if inhaled.                                     *
*                                                                           *
*                                                                           pg 1 *
*****
```

```
*****
*                               C A U T I O N                               *
*                               *                                           *
* The water flow must be kept in the right direction,                   *
* opposite flow will cause resistive element burnout.                   *
*                                                                           *
*                                                                           pg 2 *
*****
```

Continued

\*\*\*\*\*  
\* C A U T I O N \*  
\*  
\* Be sure cooling liquid is flowing through the load \*  
\* before RF power is applied and make sure the cooling \*  
\* liquid supply is not interrupted while load is in \*  
\* operation. Even momentary interruption of coolant \*  
\* supply while load power is applied will cause almost \*  
\* immediate burnout. \*  
\* pg 7 \*  
\*\*\*\*\*

\*\*\*\*\*  
\* C A U T I O N \*  
\*  
\* Never reverse the cooling water connections. It is \*  
\* very important for the safety of the load resistor to \*  
\* observe proper flow direction. Also, when the load is \*  
\* first installed or is reconnected, run the water for \*  
\* approximately a minute to fill the system and remove \*  
\* all bubbles before turning on the RF power. \*  
\* pg 7 \*  
\*\*\*\*\*

\*\*\*\*\*  
\* W A R N I N G \*  
\*  
\* Never attempt to disconnect the equipment from the \*  
\* transmission line while RF power is being applied. \*  
\* Leaking RF energy is a potential health hazard. \*  
\* pg 7 \*  
\*\*\*\*\*

\*\*\*\*\*  
\* C A U T I O N \*  
\*  
\* Do not disconnect water flow switch leads from control \*  
\* assembly. Any operation of the load without proper \*  
\* functioning of cooling system will cause immediate \*  
\* destruction of the resistor element. \*  
\* pg 8 \*  
\*\*\*\*\*

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## MODEL 8730/31/38 ECONOLOAD® RF LOAD RESISTOR

### INTRODUCTION

### PURPOSE AND FUNCTION

The Model 8730/31/38 Load Resistor is designed as a compact, low-reflection and non-radiating termination for medium power levels in RF transmission lines. Cooled by internal water flow, it generates almost no ambient heat, making installation space minimal and convenient. It dissipates up to ten kilowatts continuous power as used with 50 ohm coaxial transmission lines.

These models are designed for use with certain connector types of 3-1/8 and 1-5/8 inch coaxial lines. See Specifications, Page vi, for individual models. They maintain a VSWR of less than 1.1 from 1000 Hz. These models are intended for use on CW, AM, FM, SSB and TV modulation envelopes.

### DESCRIPTION

The Model 8730/31/38 equipment consists basically of the Load Resistor unit; an accessory protective control system is available as optional equipment. When duly installed, this system protects the load by shutting off RF power when flow is too low or interrupted. Discussions of the Flow Control (Installation and Maintenance Sections) herein should be ignored when not applicable. These models have the feature of field replacement of the resistor and other parts described in the Maintenance Section (see para 4-6, Replacement Procedure for Resistor and Related Parts and para 4-12, Replacement of Fractured Resistor or Damaged Internal Parts).

For direct reading of power measurements up to ten kilowatts, these loads may be used in conjunction with Bird Models 460, 4805, or 4712 THRULINE® Wattmeters.

## SPECIFICATIONS FOR MODEL 8730/31/38 ECONOLOAD® LOAD RESISTOR

---

|                              |                                                    |
|------------------------------|----------------------------------------------------|
| Impedance.....               | 50 ohms nominal                                    |
| VSWR.....                    | 1.1:1, 1000 Hz-1.0 GHz                             |
| Connectors                   |                                                    |
| Model 8730.....              | 1-5/8" EIA Flanged                                 |
| Model 8731.....              | 3-1/8" EIA Flanged                                 |
| Model 8738.....              | 3-1/8" Unflanged                                   |
| Power Modes.....             | CW, AM, FM, TV, SSB                                |
| Power Rating.....            | 10 kW average                                      |
| Frequency Range.....         | 1000 Hz-1000 MHz                                   |
| Dimensions                   |                                                    |
| All Models.....              | Housing Dia. 2-1/4"<br>(57 mm)                     |
|                              | Overall Length   Max. Dia.                         |
| Model 8730.....              | 13-31/64"       4-1/4"<br>(343 mm)       (108 mm)  |
| Model 8731.....              | 13-23/64"       5-3/16"<br>(339 mm)       (132 mm) |
| Model 8738.....              | 13-23/64"       4-1/4"<br>(339 mm)       (108 mm)  |
| Water Temperature Range..... | +5° to 60°C (41 to 140F)                           |
| Cooling Method.....          | Potable or city water                              |
| Water Connections.....       | 3/4" standard hose thread                          |
| Minimum Water Flow.....      | 4 gpm (15.2 lpm) at 5°C                            |
| Weight.....                  | Approx. 7 lb (3.18 kg)                             |
| Operating Position.....      | Any                                                |
| Finish.....                  | Lusterless black enamel                            |
| Housing Material.....        | Aluminum                                           |
| Maintenance.....             | All components<br>replaceable in the field         |

---

## SECTION I - INSTALLATION

### 1-1. GENERAL

1-2. The compact design of the Models 8730/31/38 enables the load to be installed in very small spaces. It requires no ventilation and may be placed at any attitude. Do not install where it will be subjected to severe vibration or physical shock.

1-3. The load is ready for connection as received from the factory. It is useful to check the 50 ohm input resistance of the load, before attachment (see Section IV - Maintenance).

### 1-4. LOAD RESISTOR ATTACHMENT

```
*****
*                                     W A R N I N G                                     *
*                                                                                       *
* When using dry cleaning solvents, provide adequate                             *
* ventilation and observe normal safety precautions.                             *
* Many dry cleaning agents emit toxic fumes that may be                         *
* harmful to your health, if inhaled.                                             *
*****
```

1-5. Clean all conductors and insulator surfaces on transmission line face if required and check RF input connector. Use any commercial dry cleaning solvent on cotton swab stick.

1-6. Attach the load resistor to the RF line, but do not tighten. Use connector kits for respective models as follows:

a. Model 8730; 1-5/8 inch EIA, swivel flange, 50 ohms.

1. Use 1-5/8 inch EIA coupling kit, P/N 4712-020 which includes: four each 5/16-18 x 1-1/2 inch machine screw and nut sets, O-Ring, and anchor bullet.

b. Model 8731; 3-1/8 inch EIA, swivel flange, 50 ohms.

1. Use 3-1/8 inch EIA coupling kit, P/N 4600-020, which includes: six each 3/8-16 x 1-1/2 inch machine screw and nut sets, O-Ring, and insulated center bullet.

2. Insert the center bullet, push in to seat insulator in facing, and install O-Ring in groove if required.

3. Connect coaxial input in a straight line, pushing carefully on center contact to close. The swivel flange on the ECONOLOAD® RF Load Resistor makes connection independent of a fixed flange on the coaxial input.

4. Insert bolt sets, tighten evenly all around.

c. Model 8738; 3-1/8 inch unflanged, 50 ohms, flush center conductor.

1. Use coupling kit, P/N 5-726 which includes: outer sleeve with two clamping bands and the center conductor coupling bullet.

2. Insert center bullet and bottom it on the midpoint nibs.

3. Position the outer sleeve, with clamp bands, over input connector.

4. Introduce transmission line and seat snugly against the coupling stops.

5. Position clamp bands evenly about 1-3/4 inches apart and tighten.

1-7. Rotate the load so that the warning label shows and the OUTLET water tube is placed to best advantage. Tighten RF connection, securing the clamps or bolt sets firmly and evenly.

1-8. Do not disturb the socket head cap screws joining the connector section to the main housing.

#### 1-9. WATER LINE ATTACHMENT

```
*****
*                               C A U T I O N                               *
*                               *                                           *
* The water flow must be kept in the right direction,                    *
* opposite flow will cause resistive element burnout.                    *
*****
```

1-10. The RF load comes supplied with standard 3/4 inch hose fittings. The water INLET (at the back on center) and water OUTLET (adjacent, at 90° to Inlet) mate with 3/4 inch water hose connectors. The optional water flow switch is installed on the water line (see para 1-13). For rigid piping connections, replace both the water INLET and OUTLET hose adapters, Bird P/N 5-065-2, with 1/2 inch male pipe fittings.

#### 1-11. COOLING WATER QUALITY

1-12. Water quality is important. Refer to para 2-7, Cooling Water for explanation and description. In general, any potable water is satisfactory. This would include: purified, filtered city supply or soft water (demineralized).

#### 1-13. FLOW SWITCH (Optional Item)

1-14. The ports of the flow switch are 3/4 inch NPT Female. the direction of flow is marked on the casting of the flow tube and on the operating head. Observe carefully as opposite connection will restrict water flow and cause load failure. The flow switch may be connected to the inlet or the outlet

pipe of the load, but be certain the water flow through the switch is in correct direction. connect with a 1/2 inch NPT nipple and a 1/2 inch to 3/4 inch bushing, Part Numbers 5-489-1 and 5-490-1. Or connect by hose or pipe, with the flow switch not over 20 feet from the load. Attach the hose to the switch with a 3/4 inch hose nipple P/N 5-903.

- a. Do not connect the flow switch leads at this time.
- b. Turn on the water and check the system for leaks and operation.

#### 1-15. CONTROL BOX (Optional Item)

1-16. The wiring center and the remaining elements of the control system are contained in the control box. This includes the terminal strip and three "BX" cable clamps for the input connections, a pilot lamp and the delay timer. Only wiring material is needed. These units can be ordered to operate on either 115 Vac or 230 Vac, P/N 8750-101-1 and 8750-101-2 respectively.

1-17. The pilot lamp atop the box is a safe operation signal; it lights only when ac power is on and adequate water supply is flowing. After the pilot goes on a 12  $\pm$  2 second timer delay allows time for water flow to stabilize before closing the transmitter interlock.

1-18. The control box is mounted through four 1/4 inch holes on a 5 x 5 square in the back. Position it for the best view of the pilot light and easy attachment of "BX" cable and wiring. Connect leads for both voltages as follows:

- a. Water Flow switch leads to terminals 3 and 5.
- b. Interlock Switch leads to 6 and 7.
- c. AC power to 2 and 3 for 115 Vac or 230 Vac operation.

1-19. NOTE: These connections are critical - wire carefully.

#### 1-20. PREOPERATIONAL CHECKOUT

1-21. Before attempting to operate the RF load either under test or actual operating conditions, test the complete water system and interlock control as follows:

- a. Make sure the ac and transmitter interlock power are off.
- b. Connect an ohmmeter across terminals 6 and 7 (interlock).
- c. Turn on ac power.
- d. Turn on the water supply and note when water flow switch operates (audible click).
- e. In not less than ten seconds (12  $\pm$  2) the ohmmeter reading on 6 and 7 should drop, indicating operation of the time delay switch.

f. Water flow from outlet of the load must be at least 4 GPM.

1-22. NOTE: As a precautionary measure, the preoperational checkout should be performed each time the load is to be put into service.

## SECTION II - THEORY OF OPERATION

### 2-1. GENERAL

2-2. The TERMALINE® Coaxial Load Resistor is unique in that it employs primarily external water cooling of the resistor element. By using this technique, the need for an intermediate dielectric fluid to transfer the heat generated in the resistor element has been eliminated, reducing the physical size of the load to a virtual minimum. This simplified system allows use of the loads in more varied environments and attachment at any attitude (see Specifications, Page vi).

### 2-3. HEAT TRANSFER

2-4. The 50 ohm resistor consists of hi-temp substrate tube with a deposited resistive film. The heat generated by absorption of RF power is transferred from the heated film to the water flowing over it through a restricted chamber surrounding the resistor body. This water, first conducted to the front of the load resistor, passes over the entire length of the resistor and discharges through the sealed water chamber at the rear. The dielectric characteristics and distinctive design of these enclosures provide a very accurate 50 ohm termination over the specified frequency range of this load, 1000 Hz to 1000 MHz.

2-5. The absence of intermediate cooling fluids considerably simplifies the construction and sealing of this unit. It can be readily disassembled in the field for resistor element replacement (see Section IV - Maintenance).

2-6. Because there is practically no heat transfer to the outer housing of the load, it remains at ambient temperature even under full power application. Virtually all of the power input to the load is transformed into heat which is carried away by the cooling water. Therefore, the differential in input and output temperatures of the water times the amount of flow constitutes a very accurate measurement of the power consumed by the load. The amount of this power dissipation may be calculated from the following formula:

$$\text{Equation 1: } P = 0.263 (T_1 - T_2) \text{GPM}$$

Where: P = Power in kilowatts  
T<sub>1</sub> = Outlet water temperature in °C  
T<sub>2</sub> = Inlet water temperature in °C  
GPM = Water flow in gallons per minute

In °F the formula is :  $P = 0.146(T_1 - T_2) \text{ GPM}$

### 2.7 COOLING WATER

2-8. The electrical performance of these RF loads is affected by impurities or other chemical additives in the water. The presence of salts in the water definitely makes the device unusable as it causes rapid increase in VSWR. Therefore, sea water or silty water should not be used for cooling the loads.

2-9. The thermal performance of this series of loads is affected by impurities, particularly those impurities that accumulate in the form of scale on the exposed surfaces of the water-conducting members of the load assembly. This may result in an increase in the thermal and/or fluid resistance of the load and in turn cause the load to overheat and fail.

2-10. The following types of water are considered safe for the cooling of this series of loads: purified, filtered city, or soft water (demineralized). In general, any potable water is suitable for cooling the load.

#### 2-11. FLOW INTERLOCK CONTROL CIRCUIT (OPTIONAL)

2-12. The interlock control circuit provides instantaneous fail-safe protection of the transmitter and load in the event of even momentary interruption of the cooling water supply. This protection is necessary because dissipation of the heat generated by the RF power absorption is critically dependent upon a required minimum water flow regardless of inlet water temperature.

2-13. The water flow switch, attached to the water inlet of the load, is factory calibrated to open the electrical contacts whenever water flow drops below four gallons per minute and close when water flow exceeds this value. When the water flow switch contacts open, the time delay relay switch is deactivated, which in turn opens the interlock switch causing immediate shutdown of the transmitter or other signal source. The time delay switch also keeps the interlock switch open for a  $12 \pm 2$  second interval after the minimum flow of four gallons per minute has been re-established. This safeguarding feature assures proper operation of the cooling system before RF power can be applied to the load, preventing damage or burnout of the resistor element.

2-14. The control assembly also includes a large, torpedo-lens pilot light set on top of the box. Mounted in this position, the red pilot lamp should be freely visible from nearly all front angles in the operating vicinity of the Load Unit/Control Assembly. After proper installation, described in Section I, lighting of this pilot lamp will serve as visible indication that the RF load is ready to receive power, or of trouble in the cooling supply (control) if it is not lighted.

## SECTION III - OPERATION

### 3-1. GENERAL

3-2. The TERMALINE® RF Load is not equipped with any operating controls, and therefore requires no operator present while in use. Proper operation of the equipment is assured if the instructions contained in Section I - Installation are followed exactly.

### 3-3. NORMAL OPERATION

```
*****
*                               C A U T I O N                               *
*                               *                                           *
* Be sure cooling liquid is flowing through the load                       *
* before RF power is applied and make sure the cooling                     *
* liquid supply is not interrupted while load is in                       *
* operation. Even momentary interruption of coolant                       *
* supply while load power is applied will cause almost                   *
* immediate burnout.                                                       *
*****
```

```
*****
*                               C A U T I O N                               *
*                               *                                           *
* Never reverse the cooling water connections. It is                       *
* very important for the safety of the load resistor to                   *
* observe proper flow direction. Also, when the load is                   *
* first installed or is reconnected, run the water for                     *
* approximately a minute to fill the system and remove                     *
* all bubbles before turning on the RF power.                             *
*****
```

```
*****
*                               W A R N I N G                               *
*                               *                                           *
* Never attempt to disconnect the equipment from the                       *
* transmission line while RF power is being applied.                     *
* Leaking RF energy is a potential health hazard.                         *
*****
```

3-4. For ordinary operation of the RF load, without the optional controls described in Section I, proceed carefully as follows:

Before turning on the RF power, cooling water must be freely flowing through the load. A minimum flow of four gallons (15.1 liter) per minute at 5°C is required increased, in proportion, to 6 GPM (22.7 liter) at 60°C. There must be no interruption in this water flow during any power application to the load; instantaneous resistor burnout may occur. Also, be sure to shut off RF power well before turning off water flow.

### 3-5. OPERATING WITH OPTIONAL CONTROLS

```
*****
*                               C A U T I O N                               *
*                               *                                           *
* Do not disconnect water flow switch leads from control *
* assembly. Any operation of the load without proper *
* functioning of cooling system will cause immediate *
* destruction of the resistor element. *
*****
```

- a. Turn on ac power.
- b. Turn on water supply.
- c. Turn on interlock supply.
- d. Check that all coaxial power line connections are properly tightened.
- e. Apply RF power to load. Proceed according to instructions pertaining to the specific transmitting equipment.

### 3-6. OPERATING AS AN RF WATTMETER

3-7. The RF load can be combined with a Bird Rigid Line Series THRULINE® Wattmeter to form an absorption type wattmeter by inserting the wattmeter line section just ahead of the RF load. Installation and operation of the wattmeter is covered in the THRULINE® Wattmeter Instruction Manual. Select the wattmeter type appropriate to the input connector of the load resistor (consult the Bird catalog).

- a. Proceed with operating functions the same as Subparagraphs 3-5a-e.
- b. Rotate the element in the line section to monitor incident or reflected power. Measurements are taken as indicated by direction of the arrow on the element.

### 3-8. SHUTDOWN

- a. Turn off RF power to the load.
- b. Wait at least one minute for load to cool.
- c. Turn interlock and ac power off.
- d. Turn off the water supply. Always do this last.

## SECTION IV - MAINTENANCE

### 4-1. GENERAL

4-2. The Model 8730/31/38 Coaxial Load Resistor is a rugged unit of simple design, requiring only nominal and routine attention. The load is designed to operate for long periods of time if care is taken not to exceed its power handling capabilities.

4-3. The outside surface of the unit should be wiped free of dust and dirt at regular intervals if necessary. Disconnect the load resistor from the transmission line and clean the RF input connector, both metallic and insulator surfaces. Use an aerosol type contact cleaner or any good dry cleaning solvent on a cloth. Always handle the load with care to prevent subjection to unnecessary shock or impact.

### 4-4. RF LOAD RESISTOR

4-5. Accurate measurement of the dc resistance between the inner and outer conductors of the RF input connector will provide a good check of the condition of the load resistor. For this measurement, a resistance bridge or an ohmmeter with an accuracy of one percent or better at 50 ohms should be used. Use low resistance leads, preferably a short piece of 50 ohm coaxial cable. The measured resistance should not deviate more than 2 ohms from the value stamped on the manila tag attached to the load. It is recommended that this resistance check be performed each time the load is to be used.

### 4-6. REPLACEMENT PROCEDURE FOR RESISTOR AND RELATED PARTS

4-7. This series of water cooled loads is designed to be quickly and easily repaired in the field. If in performing the dc resistance check described in para 4-4 a significant change in resistance is noted, or if for any reason the resistive element or any other part should fail, inexpensive replacement parts are available. They can be readily installed in the load, using the following procedures:

4-8. Resistor Removal - Part numbers designated by brackets [] in this text are so indicated on Figures 4-1 and 4-3.

a. If the load is not already removed from the system, disconnect the water hoses at the hose fittings [5] on the load and disconnect the unit from the RF transmission line.

b. Set the load on end, with the water connections up, and use a 5/64 inch Allen wrench to remove the 8-32 x 1/8 cup point socket set screw [12] located on the side of the water chamber sub-assembly [3]. Unscrew the water chamber grasping the housing assembly with one hand and turning the water chamber sub-assembly counterclockwise until the threads disengage, then pull the water chamber off the end of the load housing assembly [10]. If necessary, hose nipples [5] or inlet seal O-Ring [4] may be removed and replaced (see Figure 4-1).

c. Remove the retainer sleeve [6] and sleeve back-up O-Ring [7]. Inner flow tube [8] may now be removed. Next grasp resistor ground cap [9] and remove it by pulling with a slight rocking motion.

d. The end of the resistor [1] will now be exposed. Carefully withdraw the resistor, with a slight rocking motion if needed, from the load housing. Note carefully at this point that the spacer ring [30] remains nested inside the resistor fitting [16] or [22]. It should be there at reassembly. If displaced, it may have to be repositioned. Be sure to bottom the spacer ring.

#### 4-9. INSPECTION

4-10. At this point, if the resistor has been successfully removed, inspect it carefully to insure that it is not fractured. In the majority of cases, even in the event of resistor failure, the resistor substrate will remain intact. Next, examine the inside of the load housing assembly for any apparent damage to the internal parts. If no damage has been found, proceed with Subpara 4-11a. If however, the resistor is broken, other internal parts appear to be damaged, or if they do not fit together properly, proceed to 4-13, Replacement of Fractured Resistor or Damaged Internal Parts.

#### 4-11. RESISTOR REPLACEMENT

a. Insert the new resistor [1] into the load housing until it reaches the resistor fitting, then gently rotate and rock the resistor until it starts to enter its way into the resistor fitting. Push the resistor into the fitting until it bottoms on the spacer ring [30]. If the resistor seems to be loose, refer to 4-13, Replacement of Fractured Resistor or Damaged Internal Parts, for instructions on how to tighten the resistor fitting.

b. If damaged, replace the inner flow tube. If undamaged, place the original flow tube [8] inside the resistor [1] and lower it until it reaches the resistor fitting. Gently work and twist the inner flow tube until it seats in the bottom of the resistor fitting.

c. Place the resistor ground cap [9] on the exposed end of the resistor, (see Figure 4-1) and press it into place. Slide the sleeve back-up O-Ring [7] on the inner flow tube until it rests on the end of the resistor. Then slide the retainer sleeve [6] down the inner flow tube until it rests on the O-Ring [7], insuring that the end of the retainer sleeve with the larger inside diameter goes on first.

d. Check the inlet seal O-Ring [4] to see that it is properly seated in its groove in the inside of the water chamber sub-assembly [3]. Then place the water chamber sub-assembly in place, see Figure 4-1, on the end of the load housing assembly [10] and tighten by screwing the water chamber onto the threaded end of the load housing assembly (clockwise).

e. After tightening the water chamber assembly until it bottoms snugly, replace the 8-32 x 1/8 cup point socket set screw [12] and tighten securely. Check the dc resistance between the outer and

inner conductors; it should be approximately 50 ohms (see para 4-5). Then connect the load to the water source and check for leaks. If no leaks appear and if the results of the above dc resistance check are satisfactory the load is ready for service.

4-12. Take particular care of the outside surface of the resistor/s. Treat the surface gently, wiping with a soft cloth. No firing, sanding, or abrasive action should be used.

#### 4-13. REPLACEMENT OF FRACTURED RESISTOR OR DAMAGED INTERNAL PARTS

#### 4-14. RESISTOR REMOVAL

a. The load should already be disassembled to the point of step 4-8d. Turn the load on end, with the RF input connector up to allow pieces of parts, if present, to fall out of the load housing.

b. Using a 3/16 Allen wrench, loosen and remove the six 1/4-20 x 1/2 inch hex head screws [29] from the flanged end of the load housing assembly, as shown in Figure 4-1. The outer conductor assembly [19], [26], or [28] may now be easily removed.

c. Next remove the input center conductor assembly, see Figure 4-1, by pulling it out of the load housing assembly [10]. Rinse all parts under clear running water to remove any remaining chips or pieces.

#### 4-15. INPUT CENTER CONDUCTOR ASSEMBLY

a. Model 8730, 1-5/8 inch EIA flanged input connector only, Figure 4-2.

1. Remove the 1/4-20 x 3/4 pan head machine screw [20] and 1/4 split lockwasher [21] by unscrewing Item [20] while holding the center conductor [18] stationary. The center conductor [18], the center conductor adapter [17] and the insulator [15] may now be easily removed from the rest of the assembly.

2. Remove the resistor fitting [16] by pushing the exposed end of the fitting into the outer flow tube [13]. The resistor fitting and any broken pieces of resistor will then fall from the opposite end of the outer flow tube (see Figure 4-2).

3. Inspect all O-Ring seals, metal and internal parts for damage. The metal parts may be discolored or oxidized and may be cleaned by rubbing with fine steel wool. The Teflon parts are cleaned with detergent and water. However, if any of the internal parts are damaged they must be replaced to insure proper electrical and/or thermal performance of the load. Insert the replacement resistor [1] into the resistor fitting [16]. Be sure the resistor spacer ring [30] is in place and that the resistor [1] bottoms on it (see Figures 4-2 and 4-3). If the fitting is loose press the slotted finger contacts of the fitting together slightly and try the resistor again. Continue this procedure until a snug fit is obtained.

4. Reassemble input center conductor assembly. First replace outer flow tube seal O-Ring [14], if necessary, then insert resistor fitting [16] in position in the outer flow tube [13] as shown in Figure 4-2. Replace insulator [15] center conductor adapter [17] and center conductor [18]. Tighten in place with 1/4-20 x 3/4 pan head machine screw [20] and 1/4 split lockwasher [21].

b. Model 8731, 3-1/8 inch EIA flanged and Model 8738, 3-1/8 inch unflanged input connector, Figure 4-3.

1. Loosen and remove the 3/8-16 hex nut [24], and the 3/8 split lockwasher [25] with a 9/16 socket or nut driver while holding the center conductor stationary. The center conductor [23] for Model 8731 and [27] for Model 8738 and the insulator [15] may now be easily removed.

2. Remove the resistor fitting [22] by pushing the exposed threaded end of the fitting into the outer flow tube [13]. The resistor fitting [22] and any broken pieces of resistor will now fall from the opposite end of the outer flow tube (Figure 4-3).

3. Inspect all internal parts and O-Ring seals for damage. The metal parts may be discolored or oxidized and may be cleaned by polishing with fine steel wool. The Teflon parts are cleaned with detergent and water. However, if any of the internal parts are damaged they must be replaced to insure the proper electrical and/or thermal performance of the load.

4. Insert the replacement resistor [1] into the resistor fitting [22], being sure resistor spacer ring [30] is in place and that the resistor [1] bottoms on it (see Figures 4-2 and 4-3). If the fitting is loose press the slotted finger contacts together slightly and try the resistor again. Continue this procedure until a snug fit is obtained.

5. Reassemble the input center conductor assembly by first replacing the outer flow tube seal O-Ring [14], if necessary. Then insert the resistor fitting [22] in position in the outer flow tube [13] as shown in Figure 4-3. Replace insulator [15] and center conductor, [23] for Model 8731 and [27] for Model 8738, and tighten in place with 3/8-16 hex nut [24] and 3/8 inch split lockwasher [25].

#### 4-16. Final Assembly

a. Replace the input center conductor assembly by lowering it into the flanged end of the load housing assembly, Figure 4-1, and pressing it in place.

b. Remount the outer conductor assembly, [19] for Model 8730, [26] for Model 8731, or [28] for Model 8738, by placing the flange with the threaded holes against the flange of the housing assembly [10] and cap by tightening the six 1/4-20 x 1/2 hex head cap screws [29] securely (see Figure 4-1).

c. Continue with instructions given in Subpara 4-11a-e.

#### 4-17. RETESTING

4-18. After completion of any of the above replacement or reassembly operations, power test the restored load unit at 10 kW with 50/60 Hz current for at least one-half hour with required water flow.

FIGURE 4-1. LOAD ASSEMBLY, EXPLODED VIEW.

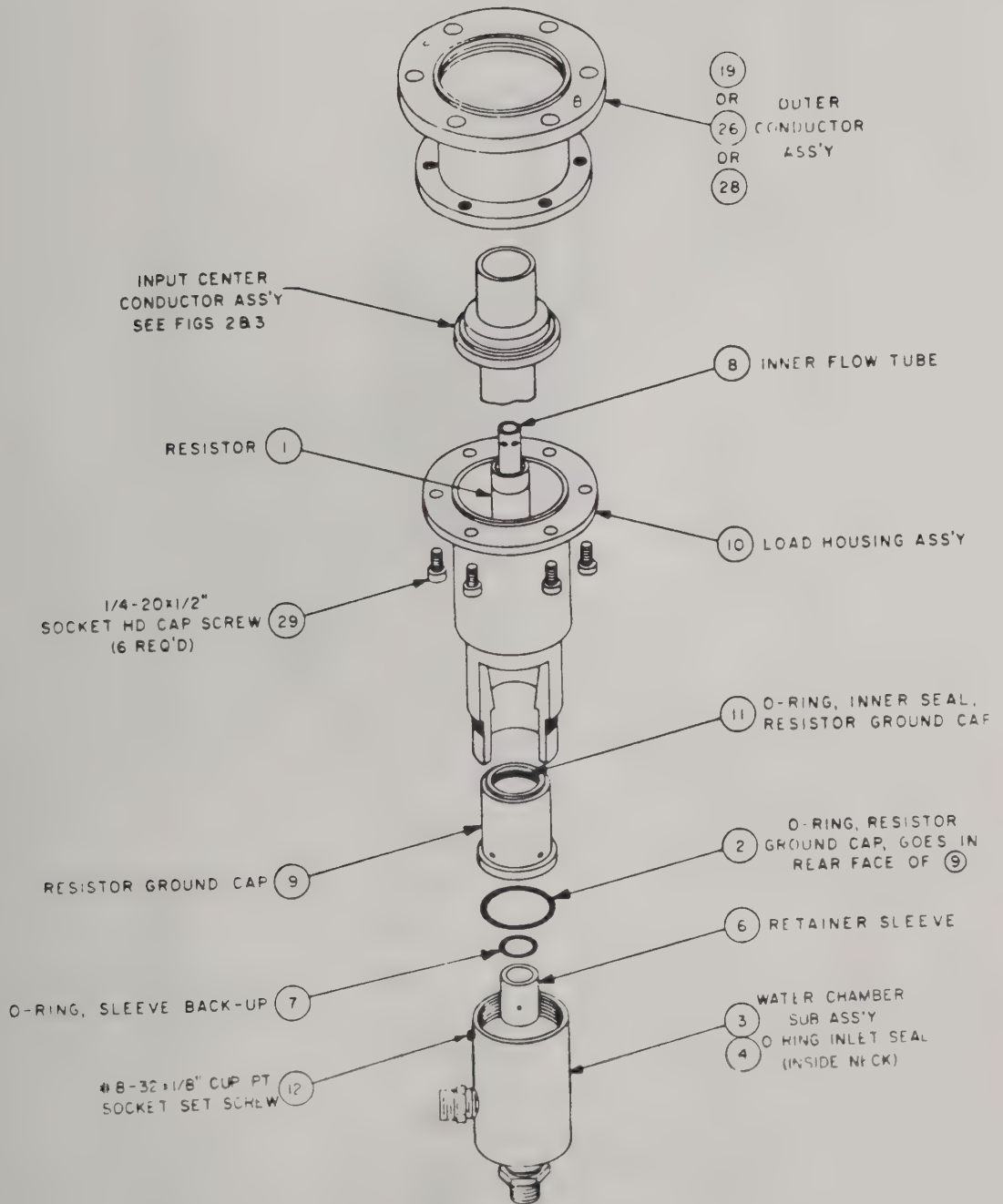


FIGURE 4-2. MODEL 8730 INPUT CENTER CONDUCTOR ASSEMBLY.

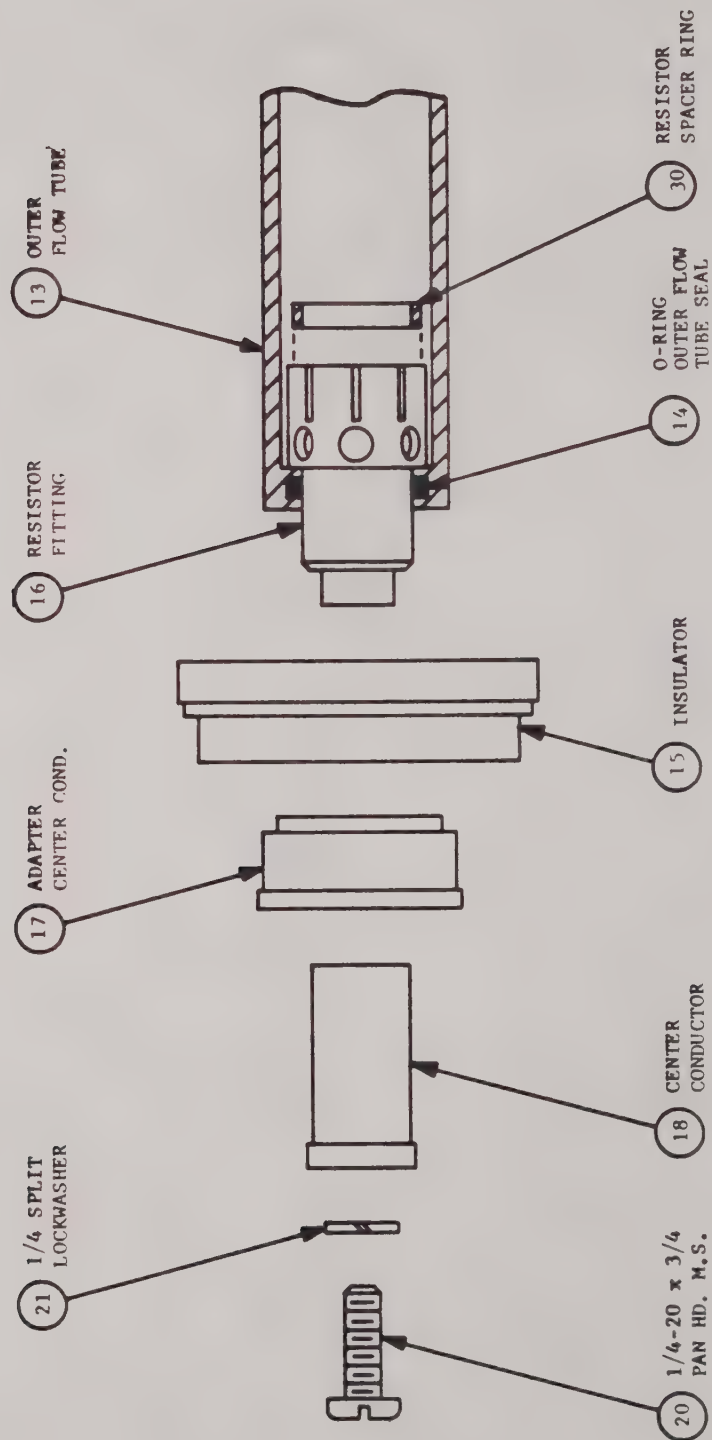
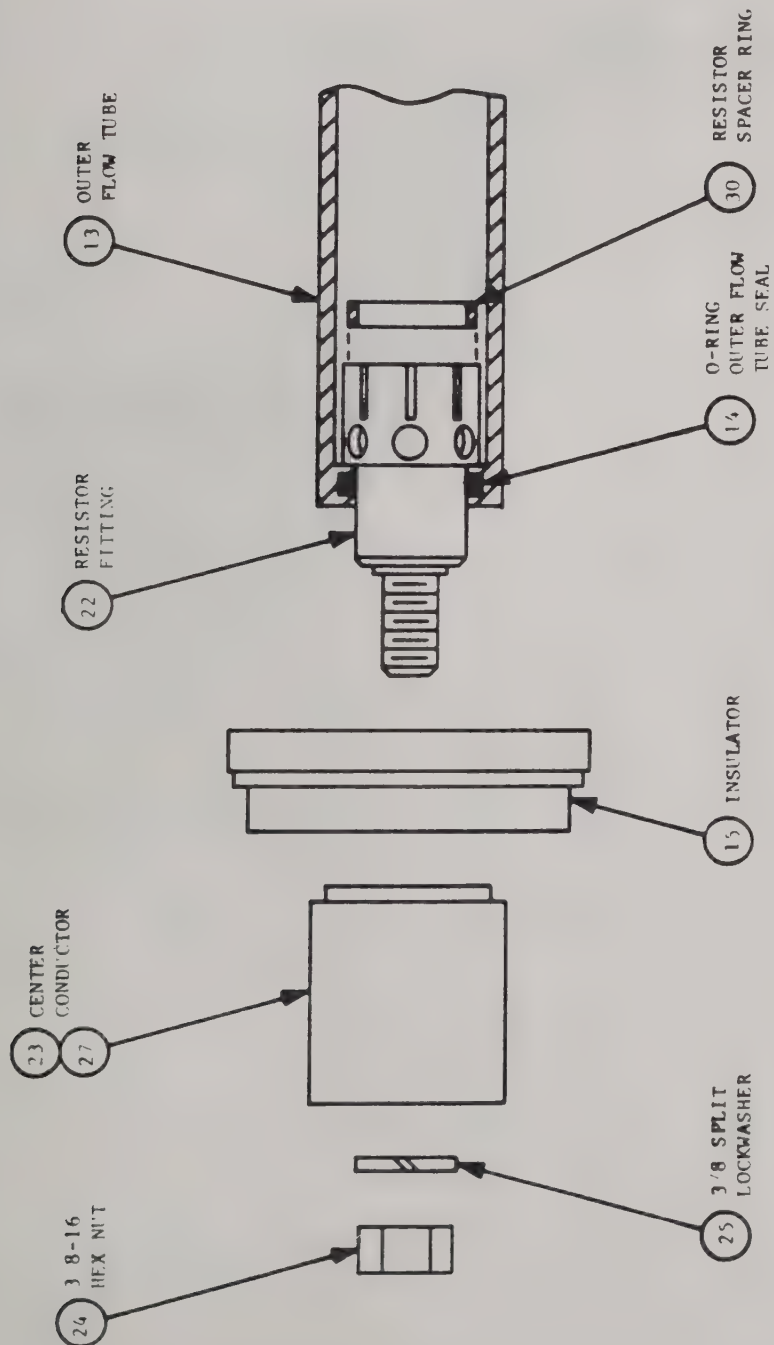


FIGURE 4-3. MODEL 8731/8738 INPUT CENTER CONDUCTOR ASSEMBLY.



#### 4-19. REPLACEMENT PARTS LIST

#### 4-20. MODELS 8731, 8738 AND 8730 LOAD RESISTOR

| ITEM | QUANTITY | DWG<br>REF NBR | DESCRIPTION                              | PART NUMBER |
|------|----------|----------------|------------------------------------------|-------------|
| 1    | 1        | 1              | Resistor                                 | 8731-021    |
| 2    | 1        | 2              | Resistor ground cap rear seal O-Ring     | 5-176       |
| 3    | 1        | 3              | Water chamber subassembly                | 8731-025    |
| 4    | 1        | 4              | Inlet seal O-Ring                        | 5-430       |
| 5    | 2        | 5              | Hose nipple                              | 5-065-2     |
| 6    | 1        | 6              | Retainer sleeve                          | 8731-023    |
| 7    | 1        | 7              | Sleeve backup O-Ring                     | 5-1142      |
| 8    | 1        | 8              | Inner flow tube                          | 8731-022    |
| 9    | 1        | 9              | Resistor ground cap                      | 8731-007    |
| 10   | 1        | 10             | Housing assembly                         | 8731-002    |
| 11   | 1        | 11             | Resistor ground cap internal seal O-Ring | 5-187       |
| 12   | 1        | 12             | 8-32 x 1/8 cup point socket set screw    | Standard    |
| 13   | 1        | 13             | Outer flow tube                          | 8731-016    |
| 14   | 1        | 14             | Outer flow tube seal O-Ring              | 5-099       |
| 15   | 1        | 15             | Insulator                                | 8731-018    |

Front Connector Parts Assigned Per Model Type Below:

Model 8730 - 1-5/8" EIA Flanged Connector - 50 ohms

|    |     |    |                                     |          |
|----|-----|----|-------------------------------------|----------|
|    | (1) |    | Center conductor assembly           |          |
| 16 | 1   | 16 | Resistor fitting                    | 8730-008 |
| 17 | 1   | 17 | Center conductor adapter            | 8730-009 |
| 18 | 1   | 18 | Center conductor                    | 8730-010 |
| 19 | 1   | 19 | Outer conductor assembly            | 8730-002 |
| 20 | 1   | 20 | 1/4-20 x 3/4 pan head machine screw | Standard |
| 21 | 1   | 21 | 1/4 split lockwasher                | Standard |

Model 8731 - 3-1/8" EIA Flanged Connector - 50 ohms

|    |     |    |                           |          |
|----|-----|----|---------------------------|----------|
|    | (1) |    | Center conductor assembly |          |
| 22 | 1   | 22 | Resistor fitting          | 8731-017 |
| 23 | 1   | 23 | Center conductor          | 8731-015 |
| 24 | 1   | 24 | 3/8-16 hex nut            | Standard |
| 25 | 1   | 25 | 3/8 split lockwasher      | Standard |
| 26 | 1   | 26 | Outer conductor assembly  | 8731-004 |

# REPLACEMENT PARTS LIST [CONT.]

|                                                   |          | DWG     |                                     |             |
|---------------------------------------------------|----------|---------|-------------------------------------|-------------|
| ITEM                                              | QUANTITY | REF NBR | DESCRIPTION                         | PART NUMBER |
| Model 8738 - 3-1/8" Unflanged Connector - 50 ohms |          |         |                                     |             |
|                                                   | (1)      |         | Center conductor assembly           |             |
| 27                                                | 1        | 22      | Resistor fitting                    | 8731-017    |
| 28                                                | 1        | 24      | 3/8-16 hex nut                      | Standard    |
| 29                                                | 1        | 25      | 3/8 split lockwasher                | Standard    |
| 30                                                | 1        | 27      | Center conductor                    | 8738-005    |
| 31                                                | 1        | 28      | Outer conductor assembly            | 8738-002    |
| For All Models                                    |          |         |                                     |             |
| 32                                                | 6        | 29      | 1/4-20 x 1/2" socket head cap screw | Standard    |
| 33                                                | 1        | 30      | Resistor spacer ring                | 8731-008    |

## SECTION V - OPTIONAL EQUIPMENT

### 5-1. GENERAL

5-2. Procurement and use of the accessory protective control system, comprising the water flow switch and control box, is optional. Consider the replaceable parts described in para 5-3, 5-5 and 5-7 when applicable (see list following these sections).

### 5-3. WATER FLOW SWITCH

5-4. The Water Flow Switch, P/N 5-898-6, should be checked and cleaned of any accumulated dirt or scale that might impede free movement of the control gate in the switch. This should be done after several months use, or if indicated. This component is non-repairable; if found defective it must be replaced. For replacement proceed as follows:

- a. Make certain RF power, 115/230 Vac, and transmitter interlock supply are turned off.
- b. Disconnect leads at the water flow switch.
- c. Remove defective switch and replace with new unit.
- d. Connect flow switch leads.
- e. Perform preoperational checkout (see para 1-20).

### 5-5. TIME DELAY RELAY

5-6. The Relay Cartridge, P/N 5-1664 or 5-1665, in the control box cannot be disassembled or repaired in the field. A faulty unit should simply be replaced according to the following procedure:

- a. Be sure RF power, 115/230 Vac, and transmitter interlock supply are turned off.
- b. Open the door of the control box by turning slotted screw head one quarter turn.
- c. Loosen the 8-32 pan head screw at the top of the relay clamp, P/N 8630-193, then press legs in slightly to release the retaining prongs of the clamp.
- d. Pull the delay relay cartridge straight out of the socket.
- e. To replace the relay, reverse the procedure above. The socket is an ordinary octal type. When inserting the relay, rotate the cartridge carefully for alignment of the center post nub in the socket.
- f. Prongs of the clamp match side slots in the socket holder. Fit the clamp in the slots and turn the head screw up snugly.

g. Reverse procedures in Subpara 5-6a. and b.

h. Perform preoperational checkout (see para 1-20).

#### 5-7. PILOT LIGHT

5-8. The pilot lamp, P/N 5-970 (-1 or -2), may be reached simply by unscrewing the pilot lamp lens, P/N 8750-106, on the topside of the control box. The bulb is a two contact bayonet type. It is easily removed by pushing down gently and slightly twisting counterclockwise. Reverse to replace.

5-9. A list of replaceable parts for the optional equipment follows:

#### 5-10. REPLACEMENT PARTS LIST

5-11. Control and water flow parts not shown on figures.

| ITEM | QUANTITY | DESCRIPTION                          | PART NUMBER |
|------|----------|--------------------------------------|-------------|
| 1    | 1        | Water flow switch                    | 5-898-6     |
| 2    | 1        | Control assembly                     |             |
|      |          | 115 V operation                      | 8750-115    |
|      |          | 230 V operation                      | 8750-230    |
| 3    | 1        | Relay retainer clamp                 | 8630-193    |
| 4    | 1        | Time delay relay                     |             |
|      |          | 115 V operation                      | 5-1664      |
|      |          | 230 V operation                      | 5-1665      |
| 5    | 1        | Indicator light                      | 8750-106    |
| 6    | 1        | Incandescent lamp                    |             |
|      |          | 115 V operation                      | 5-970-1     |
|      |          | 230 V operation                      | 5-970-2     |
| 7    | 1        | Pipe nipple (flow switch)            | 5-489-1A    |
| 8    | 1        | Hex bushing (flow switch)            | 5-490-1A    |
| 9    | 1        | Model 8730 Coupling Kit - 1-5/8" EIA | 4712-020    |
|      |          | consisting of:                       |             |
|      | 1        | Anchor bullet                        | 4712-021    |
|      | 1        | O-Ring                               | 4711-013    |
|      | 1        | Mounting hardware                    | 4711-012    |
| 10   |          | Model 8731 Coupling Kit 3-1/8" EIA   | 4600-020    |
|      |          | consisting of:                       |             |
|      | 1        | Anchor bullet                        | 4600-021    |
|      | 1        | O-Ring                               | 4600-022    |
|      | 1        | Mounting hardware                    | 4600-023    |
| 11   |          | Model 8738 Coupling Kit 3-1/8"       | 5-726       |
|      |          | Unflanged, flush, 50 ohm             |             |





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